Sem

Roll No. .....

Total No. of Questions : 9] [Total No. of Printed Pages : 4

(1109)

UGC (CBCS) Vth Semester (New) Examination

1204

PHYSICS

(Elements of Modern Physics)

(DSE)

PHYS 501

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Time : 3 Hours] **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each Section B, C, D and E and *seven* sub-questions from Section A. Question No. 1 is compulsory.

Section–A

1. Attempt any *seven* sub-questions :

   (i) Why wave nature of matter is not apparent in daily observation ?

   (ii) State *two* drawbacks of Rutherford's atomic model.

(iii) Which of the following is not a form of uncertainty principle ?

(a) $\Delta x \ \Delta p \geq h/2\pi$

(b) $\Delta E \ \Delta t \geq h/2\pi$

(c) $\Delta E/\Delta f \geq h/2\pi$, f means frequency

(d) $\Delta f/\Delta E \geq h/2\pi$

(iv) What do you mean by normalisation of a wave function ?

(v) For a particle of energy E less than step potential V_0, the Reflection coefficient is :

(a) 1

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(b) 0

(c) Greater than 1

(d) Less than 1

(vi) Compute that 1 amu = 931 MeV.

(vii) State limitations of liquid drop model.

(viii) What is a moderator ? Give *two* examples.

(ix) What do you mean by nuclear holocaust ? 2×7=14

Section–B

2. Describe in detail the Davisson and Germer Experiment. State its importance. 9

3. State postulates of Bohr's theory and deduce an expression for the energy of nth orbit of H-atom. Obtain an expression for wave number and explain spectra of H-atom as Lyman, Balmer, Paschen, Brackett and Pfund series. 9

Section–C

4. (a) State and explain Uncertainty Principle for position and momentum. Using it calculate binding energy of electron in H-atom.

   (b) How gamma ray microscope illustrates uncertainty principle ? 5,4

5. (a) Derive an expression for expectation value of position, momentum and energy operators.

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   (b) What is physical meaning of probability current ? 6,3

Section–D

6. Obtain an expression for energy eigen values and normalised eigen wave functions for a particle in an infinitely rigid one dimensional box. 9

7. (a) Discuss semi-empirical mass formula of a liquid drop model. Explain significance of various terms involved in it.

   (b) What are magic numbers ? Why number of neutrons tends to exceed number of protons in stable nuclei ? 6,3

Section–E

8. (a) What are β-rays ? Discuss its spectra. What led Pauli to postulate the existence of neutrino ? Mention the properties of neutrino too.

   (b) 20 mg of a radioactive substance of half life 1 year is kept in a box for 4 years. How much of it will disintegrate in 4 years ? 6,3

9. (a) Define Q-value of a nuclear reaction. Obtain an expression for it and hence derive the condition for exoergic and endoergic nuclear reactions.

   (b) Compare energy released in nuclear fission of 1 kg of $_{92}U^{235}$ with fusion of 1 kg of $_{1}H^{1}$. 7,2

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